



Simpson Tacoma Kraft

60 MW Biomass Combined Heat and Power Plant

Project Overview

In August 2009 Simpson Tacoma Kraft began commercial operation of a 60 MW biomass combined heat and power (CHP) plant. The facility, owned and operated by Simpson Investment Company, generates power from a combination of wood-based biomass and wood lignin (black/spent liquor) recovered from the pulping process. The biomass-based fuels are used to generate steam, which spins a turbine, making renewable power while providing process steam to the mill.

Background

Family-owned and operated for more than 120 years, Simpson Investment Company has a long history of investing in its operations to help it stay competitive. As a forest products company, it has diverse manufacturing divisions, with five wood product manufacturing plants, one pulp and paper mill co-located with a sawmill (Simpson Tacoma Kraft) and two door manufacturing plants. The Tacoma Kraft mill is thriving at a time when many pulp and paper mills across the country are closing. The mill manufactures bleached and unbleached kraft pulp and linerboard and employs some of the most advanced paper recycling techniques available. It recycles some 500 tons of waste paper and boxes every day.

According to the USA Biomass Power Producers Alliance, the facility is the largest single CHP renewable energy project built in the U.S. in the last ten years.

Quick Facts

- TYPE OF INDUSTRY:** Kraft Pulp and paper mill
- LOCATION:** Tacoma, WA
- TYPE OF SYSTEM:** Biomass combined heat and power
- PRIME MOVER:** Riley steam generator (boiler)
- RECOVERY BOILER:** Combustion Engineering fire-tube
- ELEC. GENERATING CAP:** 60 MW
Capacity of the wood-fired power plant when operating in a stand-alone electric generating mode: 27 MW
- AVG. ELECTRIC LOAD:** 55 MW
- AVG. THERMAL LOAD:** 825,000 lb/hr of 875 psi steam
- FUEL:** Hogfuel, spent black liquor, municipal wastewater sludge
- USE OF THERMAL ENERGY:** Steam for the paper processes
- SYSTEM EFFICIENCY:** 65% +
- EMISSIONS OFFSET:** 300,000 tons/yr CO₂
- ENVIRONMENTAL BENEFITS:** Reduced CO₂ and NO_x emissions, more efficient technology that saves on energy
- INSTALLED COST:** \$90 million
- SIMPLE PAYBACK:** 5 – 8 years
- OPERATION START:** August 2009

Reasons for Installing CHP

Simpson built the CHP plant to maximize energy production from their existing operations that already involve burning sawmill and paper mill by-products, wood-building demolition waste, and logging debris. The energy could then be sold. Simpson expects to sell approximately 27,500 MWh/month (yearly average) in energy. The 60 MW power generator will squeeze more energy out of the wood waste the company already burns, so the plant will burn little more wood waste than it did previously.



Aerial view of the Simpson Tacoma Kraft Mill

Main components of the CHP biomass system

- Steam boiler: Riley 340,000 PPH 875 psig
- Recovery boiler: Combustion Engineering fire-tube type, 545,000 PPH 875 psig
- Steam turbine: Dresser Rand triple-extraction condensing type, rated capacity of 60 MW
- Generator: Brush, rated capacity of 60 MW

Use of thermal energy

Steam enters the turbine at 875 psig and is extracted at 425, 180, and 65 psig

- 425 psig to drive the steam turbines to supply the boiler soot blowers
- 180 psig for drying the pulp and paper and heating the digester
- 65 psig for the liquid evaporators, boiler feed water heating, and miscellaneous process heating

Operational experience and results

The power output was a little less than the contracted amount, and significantly less than Simpson anticipated. However, the system is working as expected. There has been some difficulty in getting the power generation to mesh with the rest of the mill (because the process needs vary). As a result, they have lost some efficiency in handling the steam flow. The mill is working on optimizing the steam flow to the turbine and the process lines.

Fuels

Simpson currently uses black liquor (60%), hog fuel (36%), fossil fuel (<2%), and municipal wastewater sludge (2%) to power their biomass plant.

These fuels are available year-round but, because the housing slowdown has reduced the normal supply of scrap wood from local lumber mills, Simpson had to plan ahead and stockpile material for combustion later. As a forest products company with four other subsidiaries, Simpson has better access to biomass than most pulp and paper mills. They receive about 700 dry tons/day of biomass in various shapes and sizes. It arrives by truck, is put in a storage pile and sent to the reclaim system.

Flexibility of fuels

The mill can use a variety of fuels, including those listed above, plus wastewater sludge, sawmill and forest residuals, demolition debris, and other miscellaneous woody-type waste streams.



Steam turbine generator



Cooling tower

Environmental Profile

The mill installed an improved over-fire air combustion system for the purpose of reducing CO₂ and NO_x. Carbon dioxide (CO₂) emissions are 300,000 tons/yr lower than if the mill had generated the same amount of power from separate heat and power facilities.

The Simpson Investment Company is a participant in the American Forest and Paper Association's Sustainable Forestry Initiative Program. The label indicates that wood and paper products come from a responsible source, backed by a rigorous, third-party certification audit.

In addition, Simpson is one of five pulp and paper facilities in Washington participating in the Industrial Footprint Project, overseen by the state Department of Ecology. The primary goal of the project is to develop a performance measurement tool that will assess the environmental, economic and social impacts of the pulp and paper sector and five pulp and paper facilities in Washington State. It will result in a numeric industrial footprint score for the sector and each facility. The project has collected data from Simpson since 2007 showing that it is making considerable progress. However, the mill started making environmental changes in 2000, when the company decided to stop storing hazardous materials at their facility. The mill also began using seawater rather than fresh water for cooling purposes.

Project Benefits

- Additional revenue streams from green power sales and green energy credits
- Reduced CO₂ emissions
- More efficient technology
- Reduced odors
- Helps Simpson stay competitive when many pulp and paper mills have shut down

Financial Analysis

The total installed cost of the 60 MW biomass plant was \$90 million, which Simpson financed. Simpson also owns the plant. The electrical output is sold to Iberdrola Renewables. Simpson has two revenue streams: green power sales and green energy credits. Expected simple payback is approximately five to eight years.

Simpson sells approximately 27,500 MWh/month. The length of the Power Purchase Agreement (PPA) is ten years.

Collaborative Business Arrangement

The project was a successful collaboration between several organizations:

- Simpson partnered with Iberdrola Renewables to purchase the excess renewable power, provide transmission, and handle the logistics of wheeling it to Sacramento Municipal Utility District (SMUD). They have a 10-year PPA.
- Tacoma Power, Simpson's electric utility, handled the interconnection to the grid.
- The Department of Energy (DOE) Northwest Clean Energy Application Center (NW CEAC) works to improve policy framework and financing of CHP projects.

Partner Profiles

Iberdrola Renewables

Iberdrola Renewables, based in Portland, Oregon, is a leading renewable energy developer with over 3,000 MW of installed capacity in the U.S. Their areas of expertise are in wind and solar development, as well as energy and asset management.

Tacoma Power

This public utility provides power to over 160,000 customers in Pierce County.

Washington State University (WSU) Extension Energy Program – CHP section

The DOE Northwest Clean Energy Application Center, hosted by the WSU Extension Energy Program, assists organizations with CHP, waste heat energy, and district energy projects. The NW CEAC is one of eight clean energy centers partnered with DOE Industrial Technologies Program.

Lessons to Share

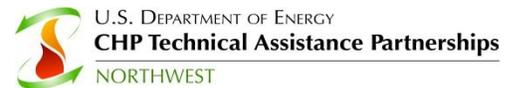
- Reliability in the fuel delivery system has been a challenge (breakdowns in conveyors that deliver fuel to the boiler) but the mill has plans to make improvements to it.
- This CHP project has resulted in a greater than expected burden of reporting to various permitting and regulatory agencies and has subjected Simpson Tacoma Kraft to numerous regulations that apply to electrical utilities, which is new to them. They must perform several reliability and security audits and they must certify compliance with the standards twice a year. In addition, Simpson must provide power production estimates to Iberdrola Renewables and periodically certify the amount of fossil fuel used in producing power.

For More Information

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